

Minimizing Implementation Loss in Soft-Decision GMSK Demodulators, Phase II

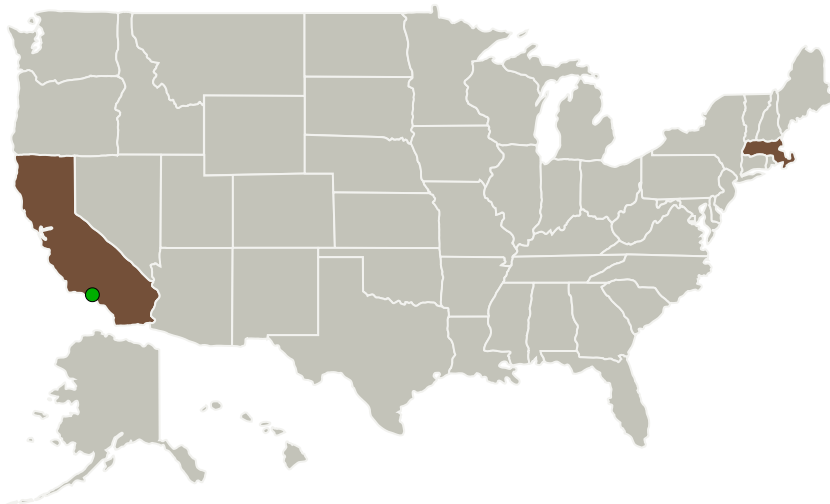
Completed Technology Project (2011 - 2013)



Project Introduction

With more missions at high data rates demanding use of limited spectral resources, NASA's SCan office recently coordinated a study to identify a space communications architecture to support future missions. The study recommends precoded GMSK and AR4JA LDPC codes as preferred options in most Space Network and Ground Network forward and return links and Deep Space Network return links. This modulation and coding pair provides excellent bandwidth-efficiency and greatly reduced transmitter SWaP. Unfortunately, there are no high-data-rate AR4JA LDPC devices currently available and existing GMSK receivers operate far from the performance predicted by theory, especially in the presence of severe channel and equipment impairments. Phase I provided a design of a soft-decision generating GMSK demodulator integrated with an AR4JA LDPC decoder and with estimation and compensation of a comprehensive set of severe impairments. Fixed-point simulations show performance within a small fraction of a dB of the performance with far less bandwidth-efficient modulations such as BPSK. The results of this effort show the technical and commercial viability of an integrated GMSK/AR4JA LDPC design. The proposed Phase 2 effort involves the development and delivery of a prototype transmitter and receiver to demonstrate the superior capabilities offered by this innovation and enable subsequent commercialization. A simple and highly flexible GUI system for prototype configuration and control and modular API design will allow Phase II refinement of the design and facilitate integration in future commercial products.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
ORB Analytics, LLC	Lead Organization	Industry	Carlisle, Massachusetts
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

**June 2011:** Project Start**May 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/139117>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ORB Analytics, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Samuel J Macmullan

Co-Investigator:

Samuel Macmullan

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Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
 - └ TX05.2 Radio Frequency
 - └ TX05.2.1 Spectrum-Efficiency

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System